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Temperature Monitoring and Regulating System for Power Saving

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Abstract— Monitoring the temperature of a computer server room is a critical task to ensure, the performance is not disturbed by excessive room temperature. In this paper we have designed and implemented a microcontroller-based room temperature monitoring and controlling system using Atmel ATmega32 microcontroller and LM35 temperature semiconductors. The project titled "Temperature monitoring and regulating system for power saving" is useful for equipments where cooling is necessary. In regions with consistent high temperature it becomes necessary to maintain equipments from getting damaged by heat. The aim of this project is to cool components by consuming least amount of power avoiding damage to hardware parts which are costly to repair. The microcontroller will take the temperature reading from the temperature sensors, which will continuously report real time temperatures. The microcontroller will then take decisions whether to turn on the fan on heated component or to keep it off. The system is provided with working status through 16x2 LCD display and buzzer as an alarm for overheated condition.

Keywords— buzzer, consistent high temperature, microcontroller, server room temperature, temperature sensors, LCD display.

1. INTRODUCTION

Temperature monitoring and control is important in environment. Sensors are widely used for measurement of temperature. Usually, a temperature sensor converts the temperature into equivalent voltage output. Here we describe a simple temperature measurement and display system based on LM35 sensor and Atmel ATmega32 microcontroller. The temperature in degree Celsius is displayed on 16x2 LCD.

2. LITERATURE SURVEY

High data usage increases heat level in computer. Fans are provided for cooling equipments. But in some cases the overheating was caused due to fan jamming. Various cooling systems were installed to overcome overheating.

Failure of these systems caused hardware damages without notice of user. As a solution to all these problems this system provides automatic cooling with status indicator from time to time.

3. BACKGROUND

Microcontroller can be designed as a single-chip special purpose computer dedicated to execute a specific application. As in general-purpose computer, microcontroller consists of memory (RAM, ROM, flash), I/O peripherals, and processor core. However, in microcontroller, the processor core is not as fast as in general purpose computer, the memory size is also smaller. Microcontroller has been widely used in embedded systems such as, vehicles, home appliances, etc. we discuss Atmel ATmega32 microcontroller and LM35 temperature sensor in this section.

3.1 ATMEL ATMEGA32 MICROCONTROLLER

The Atmel ATmega32 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega32 achieves throughputs approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed.

The ATmega32 provides the following features: 32Kbytes of In-System Programmable Flash Program memory with Read-While-Write capabilities, 1024bytes EEPROM, 2Kbyte SRAM, 32 general purpose I/O lines, 32 general purpose working registers, a JTAG interface for Boundary scan, On-chip Debugging support and programming, three flexible Timer/Counters with compare modes, Internal and External Interrupts, a serial programmable USART, a byte oriented.

Two-wire Serial Interface, an 8-channel, 10-bit ADC with optional differential input stage with programmable gain (TQFP package only), a programmable Watchdog Timer with Internal Oscillator, an SPI serial port, and six software selectable power saving modes.

3.2 LM35 TEMPERATURE SENSOR

LM35 is a precision IC temperature sensor with its output proportional to the temperature (in ^{o}C). The sensor circuitry is sealed and therefore it is not subjected to oxidation and other processes. With LM35, temperature can be measured more accurately than with a thermistor. It also possess low self heating and does not cause more than 0.1 ^{o}C temperature rise in still air. The operating temperature range is from -55°C to 150°C. The output voltage varies by 10mV in response to every ^{o}C rise/fall in ambient temperature, *i.e.*, its scale factor is 0.01V/ ^{o}C.

4. DESIGN AND IMPLEMENTATIONS

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We define to have our system specifications as follows: 1) 16x2 LCD display will give the real-time temperature. 2) The fan gets started if any part of the system is heated and its status is indicated. 3) The system will raise an alarm if the room temperature exceeds threshold.
The system consists of hardware and software parts. Simplified block diagram of circuit is depicted in fig 1. All variables needed by the software, then initializes the LCD to display that the system starts to do work. The system then enables the serial interrupt and ADC to read the temperature from LM35 sensor. The temperature is then compared to predefined threshold. If the temperature is above threshold then the buzzer beeps to warn the administrator.

The purpose of overheated condition is to avoid the system alarming continuously on each time heated which can be cooled by using fans. The fans are turned off as soon as the temperature decreases to our defined value. Thus the power is consumed.

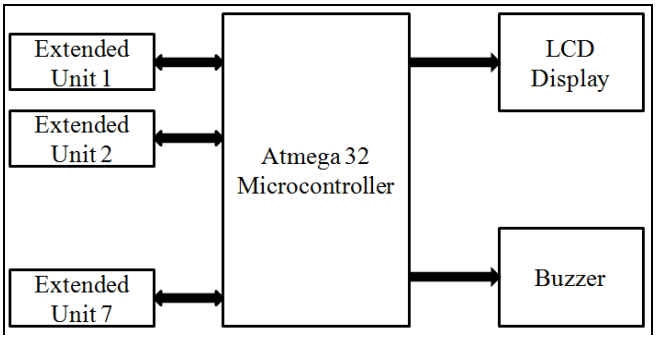

Fig 1. Experimental setup

In above diagram, seven extended units are connected to Atmel ATmega32 microcontroller. Each extended unit consists of LM35 temperature sensor and SMPS fan which acts as coolant. LCD display and Buzzer acts as an output. LCD display gives the real-time temperature and if the temperature exceeds beyond our required temperature then the fan of particular heated unit will turn on. The fan is turned off on achieving normal temperature. If the temperature is not decreasing by using fans then the temperature may get increase which may cause damage to components. When the temperature reaches to threshold then the buzzer beeps alarming the user about critical temperature and helps him to avoid the damage to components caused by overheat.

5. Result and Discussion

We have done the testing of our system. The testing was performed by heating the components at different temperatures. The temperature was taken by LM35 sensor and it was displayed on the LCD. If the temperature is increased then the fans were turned on and they are turned off as the temperature achieves the required temperature. But if the required cooling is not achieved by using fans and still the temperature goes on increasing then the buzzer beeps alarming the user about overheated condition.

6. Conclusion

In this paper we have designed and implemented the microcontroller-based system for monitoring and regulating the temperature where the temperature is high and the components may get damaged by heat. We utilized Atmel ATmega32 microcontroller and LM35 temperature sensor. This system can be used to prevent from the damage to equipments if they do not achieve required temperature. ATmega32 microcontroller and LM35 temperature sensor. This system can be used to prevent from the damage to equipments if they do not achieve required temperature.

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